

Application No. 10/029,747  
Response of April 17, 2003 to  
Office Action of January 22, 2003

**REMARKS:**

Claims 2-5, 7 and 12 have been canceled and the remaining claims rewritten in response to the rejections herein under 35 U.S.C. §112 and 35 U.S.C. §103.

Bases for the amendments to the claims are found at page 9, lines 20-28; page 9, line 32 to page 10, line 2; and page 11, lines 5-8 of the specification.

Reconsideration of this application in view of these amendments and the following remarks is respectfully requested.

The Examiner first rejected claims 1-11 of the application under 35 U.S.C. §112, first paragraph, on enablement grounds. Reconsideration and withdrawal of that rejection with respect to the amended claims are respectfully requested for the following reasons.

Applicants first note that processes and apparatus for the microwave heating of pluralities of ceramic articles are generally known. Cited British patent application GB 2,262 333, for example, discloses the heating of multiple ceramic articles in a microwave heating cavity, although in that method a thermal screen of predetermined susceptibility is required to control the application of microwave power in the heating cavity.

The Applicants' invention provides a way of avoiding the need for such susceptors during the drying and firing of ceramic honeycomb bodies. That invention is based on the discovery that field uniformity sufficient to avoid the cracking of ceramic honeycomb bodies, during either or both of the drying and the firing stages of honeycomb manufacture, can be achieved by increasing the packing density of honeycombs in the firing chamber until the field differentials within the parts are reduced to certain specified levels.

The Applicants respectfully submit that it will be apparent to those of ordinary skill in this art from a reading of the Applicants' specification that the particular packing density required in each case may depend, in a direct and simple way, on the composition and geometry of the honeycombs being made. Nevertheless it will be apparent that the particular packing density required may readily be determined by routine experiment, for example by using appropriate detectors to measure microwave field intensity variations around and within the parts. Accordingly, it is not

Application No. 10/029,747  
Response of April 17, 2003 to  
Office Action of January 22, 2003

believed that undue experimentation will be required for the practice of the invention as now claimed.

To further address the Examiner's concern in this case, the amended claims have been more particularly directed to the drying and firing of ceramic honeycomb bodies. Further, a clearer distinction has been drawn between the body spacing and field differentials required for crack-free honeycomb drying (claims 1, 6 and 8, requiring a field differential not exceeding 1.5 as disclosed at page 9, lines 20-24 of the specification), and the field differentials required during microwave-assisted honeycomb firing (claims 9-11, requiring a field differential not exceeding 5 as disclosed at page 12, lines 3-11 of the specification). The fact that these field differential limits are different for drying and firing is restated at page 11, lines 13-17 of the specification.

For the above reasons, and in view of these clarifying amendments to the claims, the Applicants respectfully submit that remaining claims 1, 6 and 8-11 are now fully compliant with 35 U.S.C. §112. Accordingly, reconsideration and withdrawal of the rejection of those claims on enablement grounds are respectfully requested.

The Examiner next rejected claims 1-3 as unpatentable over U.S. Patent No. 5,202,541 to Patterson et al. in view of U.S. Patent No. 5,538,681 to Wu. Patterson was cited to show the microwave heating of a plurality of workpieces, while Wu was cited to show the microwave drying of honeycomb bodies.

Referring more specifically to the teachings of these references, Patterson et al., U.S. Patent No. 5,202,541, (Patterson) discloses microwave heating apparatus and a method for heating industrial components to high temperatures for reacting or sintering. The disclosed method can be used for large assemblies or for the processing of large numbers of small workpieces, but the difficulty of achieving microwave heating uniformity even in volumes as small as 1.6 cm<sup>3</sup> is noted (column 1, lines 22-39 of the patent). This difficulty specifically extends to the drying and debinding of ceramics (column 1, lines 48-52 of the patent).

Patterson's solution to the problem of microwave heating non-uniformity consists of a load assembly wherein a workpiece group or assembly to be densified is surrounded by one or more electrically conductive rings (column 2, lines 53-66 of

Application No. 10/029,747  
Response of April 17, 2003 to  
Office Action of January 22, 2003

the patent). These rings, ideally spaced less than  $1/2$  of the microwave wavelength from the workpieces, apparently act to smooth the microwave fields within the rings.

What Patterson does not disclose is the nature of the workpiece assemblies being treated, or whether the isothermal conditions obtaining within the thus-modified heating chamber comprise microwave field differentials below 1.5 for drying or below 5 for firing. Further, even if such conditions could be assumed, the clear teaching of Patterson is that microwave field uniformity is to be achieved through the use of conducting rings around the heating chamber. To remove such rings, and instead attempt to achieve field uniformity through the use of a densely packed plurality of green products, would not be an obvious modification of Patterson.

The Examiner has noted the omission from Patterson of a discussion of drying ceramic materials, and thus cites Wu to show the microwave drying of ceramic green bodies. Wu forms honeycombs products from high surface area materials such as zeolite and activated carbon, and to reduce the normally long drying times needed to avoid honeycomb cracking replaces part of the water vehicle in the zeolite or activated carbon extrusion batch with oleic acid.

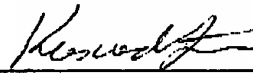
The green oleic-acid-containing extrudates of Wu can be dried in a relative-humidity-controlled oven without cracking more rapidly than can extrudates containing water alone. And, Wu teaches that rapid pre-drying utilizing known microwave or dielectric drying methods can be used in combination therewith (column 8, lines 18-55 of the patent).

Based on this disclosure the Examiner suggests that it would have been obvious to dry the honeycombs of Wu in the apparatus of Patterson. The Applicants respectfully submit, however, that such drying would still not have resulted in the invention. Clearly the Applicants' specified close packing of the plurality of green ceramic articles to achieve microwave field uniformities of 1.5 or better without using conductive rings around the heating cavity would not have been suggested. Likewise, no basis for expecting crack-free honeycomb drying without the use of an oleic acid vehicle addition is provided. Accordingly, the Applicants respectfully submit that the subject matter of claims 1-3 is not subject matter that is obvious from Patterson, Wu, or the combination thereof.

Application No. 10/029,747  
Response of April 17, 2003 to  
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For all of the above reasons, the Applicants respectfully submit that claims 1, 6 and 8-11 of this application as now amended are in full compliance with 35 U.S.C. §112 and patentable over the art of record in this case. Accordingly, reconsideration of this application and allowance of all remaining claims as amended are courteously solicited.

Respectfully submitted,



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Kees van der Sterre  
Attorney for Assignee  
Reg. No. 25,938  
Corning Incorporated  
SP-TI-3-1  
Corning, NY 14831  
(607) 974-3294

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